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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/035,400	10/26/2001	Koji Yoshida	P/1071-1505	3376

7590 10/09/2003

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EXAMINER	
RUGGLES, JOHN S	

ART UNIT	PAPER NUMBER
1756	8

DATE MAILED: 10/09/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/035,400	Applicant(s) YOSHIDA ET AL.	
	Examiner John Ruggles	Art Unit 1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 September 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Specification

The amendment filed 2 September 2003 as Paper No. 7 has overcome the previous objections to the disclosure, which are now withdrawn.

Applicants' change of the title, as previously suggested, to --Photolithographic Method of Producing a Thin Film Circuit Board Used as a Milliwave or Microwave Module-- is acknowledged and appreciated.

Claim Objections

The previous objections of claims 1-3 have been overcome by current amendments to these claims, so the previous objections are now withdrawn.

Claim Rejections - 35 USC § 112

The previous rejections under the second paragraph of 35 U.S.C. 112 have been overcome by current amendments to claims 2-3. Therefore, these previous rejections are now withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brebels, et al. (US Patent 5,675,295) in view of Kornrumpf, et al. (US Patent 5,355,102), further in view of Carey, et al. (US Patent 5,219,787), further in view of Ohya, et al. (US Patent 5,686,172), and further in view of at least one of: Trinh, et al. (US Patent 5,132,648), Peterson (US Patent 5,574,415), and/or Kroger (US Patent 4,490,733).

Brebels teaches a microwave or millimeter wave (milli-wave) oscillator device (interpreted as a module) usable in a receiver, transmitter, transceiver, or other electronic component and a method of manufacturing the device (module, column 1, lines 7-11). The transceiver (also interpreted as a module) is designed for compactness (including a thin film circuit board having a pattern area of 5 cm^2 or less) and robustness (column 4, lines 35-37). The method includes forming a first metal (conductor film) on a substrate in a predetermined pattern by lift-off technology (column 8, lines 11-12). Lift-off technology is understood to mean that a resist is patterned on the substrate, the metal conductor film is formed over the patterned resist and substrate, followed by removal of the resist along with overlying portions of metal conductor to form the patterned metal conductor film. Column 8, lines 20-35 describe forming and patterning a photosensitive or non-photosensitive organic insulation layer (film of, e.g., polyimide, photosensitive benzocyclobutene (photo-BCB), etc.) up to 10-20 microns (μm) thick to cover the metal conductor film. TiW/Au/TiW and Au are used as metal conductor film materials (column 8, lines 49-59). According to column 19, lines 22-44, thin film technology may be used to form an antenna; multiple layers of low dielectric loss (insulation layer) materials are built up (e.g., spun on, etc. – photo-BCB having a thickness in the range of 1-50 μm) to form

an insulating film; and metal (e.g., Ti/Cu/Ti, etc.) layers are deposited (formed, e.g., by vaporization, etc.) on the substrate and patterned by conventional methods. Portions of a low dielectric constant (non-photo-sensitive organic insulating film) not covered by a patterned patch or feed line (not masked) are removed by dry etching (column 19, lines 66-67, instant claim 3). If photosensitive, the low dielectric constant material is spun (formed) 20 μm thick onto a substrate (of high dielectric material having a metal conductor film formed thereon), baked by a hot plate, exposed to a pattern, developed, and baked (or cured, column 20, lines 1-6, instant claim 2). Note that by applicant's own admission on instant page 5, polyimide and benzocyclobutene inherently have stresses in the range of 15-60 MPa. Therefore, Brebels inherently teaches an insulating film stress in this range (as recited in instant claim 1) by teaching the use of these insulating film materials (e.g., polyimide, benzocyclobutene, etc.).

While teaching the other limitations of instant claims 1-3 as discussed above, Brebels does not teach: (1) cleaning a ceramic substrate (as the high dielectric substrate) having a thickness of 0.05-2 mm and a flexural strength of 500-4000 kgf/cm^2 before coating and (2) alternatively forming the conductor film from at least one of Ag, Ni, Cr, Al, Nb, and/or V.

Kornrumpf shows a microwave thin film circuit having a ceramic (e.g., alumina, etc.) substrate, which is 25-100 mils (0.635-2.54 mm) thick and reads on the 0.05-2 mm thick ceramic substrate of instant claim 1. The 12.5-75 μm thick polyimide insulating film reads on the 20 μm or greater thickness insulating film of instant claim 1. A conductor film is patterned either (1) while being deposited or (2) first deposited as a continuous layer and then patterned by etching through a patterned resist layer (column 1, lines 28-60 and column 4, lines 6-43). Additional dielectric layers of polyimide or polyimide epoxy blend are formed over the earlier polyimide

insulating film (column 10, lines 14-20 and column 11, lines 56-50). The microwave thin film circuit made by this method has a high density interconnect structure formed in a manner that provides close impedance matching, minimizes impedance discontinuities, and substantially increases the yield of good circuits (abstract).

Carey describes a process of trenching to form channels, vias, and components in a substrate, including a thin film circuit board or a high density multichip module (understood to include a waveguide, column 1, lines 50-59). The process includes cleaning an alumina ceramic substrate before coating with a polyimide insulating layer to assure acceptable contamination removal and coating adhesion (column 2, line 58 to column 3, line 4).

Ohya discloses a process of making a metal-foil-clad composite ceramic board (interpreted as a thin film circuit board) having greatly improved flexural strength applicable to a variety of fields where the excellent properties (e.g., physical, dielectric, etc.) of ceramic are essential (column 1, lines 1-28). The process of making the ceramic board includes curing the resin in a 0.1-6 mm thick resin-impregnated sintered ceramic substrate (column 5, lines 29-30), which reads on the 0.05-2 mm thick ceramic substrate of instant claim 1. Preferably, the flexural strength is at least 40-50 MPa (408-510 kgf/cm^2 *or greater*), because a 1 mm thick substrate having a flexural strength less than 40 MPa (408 kgf/cm^2) would be fragile, in which cracking is liable to occur during handling or processing (column 5, lines 56-60 and column 11, lines 3-15). This encompasses the flexural strength range of 500-4000 kgf/cm^2 recited in instant claim 1. Specific examples of flexural strength for the composite ceramic substrate ranging from 46-181 MPa (469-1846 kgf/cm^2) are shown in Tables 1, 6-1, and 6-2 found in columns 33 and 41. The metal for the foil is selected from copper (Cu), aluminum (Al), nickel (Ni), or various

combinations of these metals (column 20, lines 42-49, for Ni (understood to include Ni-Cr alloy) and/or Al of instant claim 1).

Trinh teaches a monolithic microwave integrated circuit (MMIC, used as a microwave module for radio frequency communication) made with a circuit of highly conductive material (e.g., Ag, etc.) patterned on an insulating ceramic (e.g., alumina, etc.). This microwave integrated circuit has increased thermal stability and reduced mechanical stress (column 3, lines 5-55).

Peterson shows a multilayer microwave structure (understood to be a circuit) made by building up sequentially patterned metal (e.g., Cu, Cr, Al, etc.) and insulating layers of epoxy or polyimide using standard resist patterning with or without lift-off (abstract and column 4, lines 36-57).

Kroger describes millimeter wave and microwave detectors and mixers (again, understood to be circuits) having patterned conductor electrode layers made with superconducting metal alloy of a refractory metal (e.g., Nb, V, etc.) coated on insulating layers (column 4, lines 52-54, column 6, lines 36-37, and column 9, lines 33-40).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to carry out the photolithographic process of making a microwave or milli-wave module (or circuit) as taught by Brebels using a ceramic (e.g., alumina, etc.) substrate 25-100 mils (0.635-2.54 mm) thick (which reads on the 0.05-2 mm thick ceramic substrate of instant claim 1) as shown by Kornrumpf in order to form a high density interconnect structure in a manner that provides close impedance matching, minimizes impedance discontinuities, and substantially increases the yield of good circuits. In addition, it would have been obvious to

clean the alumina (dielectric) ceramic substrate before coating with a polyimide insulating film to assure acceptable contamination removal and adhesion of the coating, as described by Carey. It would also have been obvious to use a ceramic substrate having a flexural strength of at least 408 kgf/cm^2 to avoid cracking of the substrate or circuit during handling or processing as disclosed by Ohya. This encompasses the flexural strength range of 500-4000 kgf/cm^2 recited in instant claim 1.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to manufacture the microwave circuit as taught by Brebels (Cu, Au, or Ti), Kornrumpf, Carey, and Ohya (Cu, Ni, Ni-Cr, or Al) using a conductor film made from at least one metal selected either from those already listed or alternatively from the following: Ag (taught by Trinh), Cr (shown by Peterson), Nb, and/or V (described by Kroger). This is because Brebels, Kornrumpf, Carey, Ohya, Trinh, Peterson, and Kroger all relate to the same art of circuit manufacture. This combination encompasses instant claim 1 for a conductor film including at least one selected from Cu, Au, Ag, Ni, Cr, Al, Ti, Ni-Cr, Nb, and/or V.

Response to Arguments

Applicants' arguments filed 2 September 2003 as Paper No. 7 have been fully considered but they are not deemed persuasive. On page 7 of these arguments, applicants assert that combination of the first and third embodiments of Brebels are not supported by this reference. However, Brebels' column 21, lines 26-45 expressly state the intention of combining the first and third embodiments by integrating various components of these embodiments together during combined manufacturing. In fact, combined manufacturing of plural embodiments and devices

saves time and reduces manufacturing costs (column 23, line 56). On page 8 of applicants' arguments, it is alleged that Brebels' third embodiment does not support coating low dielectric layer(s) over conductor layer(s). But, the third embodiment is described to include a slotted metal reference plane 83 between an upper low dielectric constant layer 81 and the high dielectric constant substrate 80 and that 81 is further covered by patch layer 84, which is electromagnetically coupled to a feed line 86 through the slot in 83, as shown in Figure 19C (column 20, lines 36-46). This means that low dielectric layer 81 was coated over the metal conductor layer 83. Therefore, instant claims 1-3 are still held to be obvious over the cited prior art of record and the previous rejection of these claims is maintained, making the rejection FINAL. Furthermore, the combinations of plural patterned dielectric or insulating layers over a metal or conducting layer are also shown by other cited prior art references (for example, see the above descriptions of Kornrumpf and Peterson).

The previous objections and formal rejections under the second paragraph of 35 U.S.C. 112 have been withdrawn in view of applicants' current amendments.

Also, applicants' change of the title, as previously suggested, to --Photolithographic Method of Producing a Thin Film Circuit Board Used as a Milliwave or Microwave Module-- is appreciated.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Ruggles whose telephone number is 703-305-7035. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 703-308-2464. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

John Ruggles
Examiner
Art Unit 1756

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700